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ABSTRACT

A short description of the availability of Harvard Project Physics course components is given as is a discussion of the growth of the use of Project Physics in schools, including some enrollment data and survey results. Locations of the 1970 and 1971 Summer Institutes are listed. Adaptations of Project Physics course outside the United States are discussed. A brief bibliography of articles related to Project Physics or other matters of interest is listed. An index of the Project Physics Newsletters 1 to 10 is also included. (TS)

Harvard Project Physics
A New Physical Science Course for Schools

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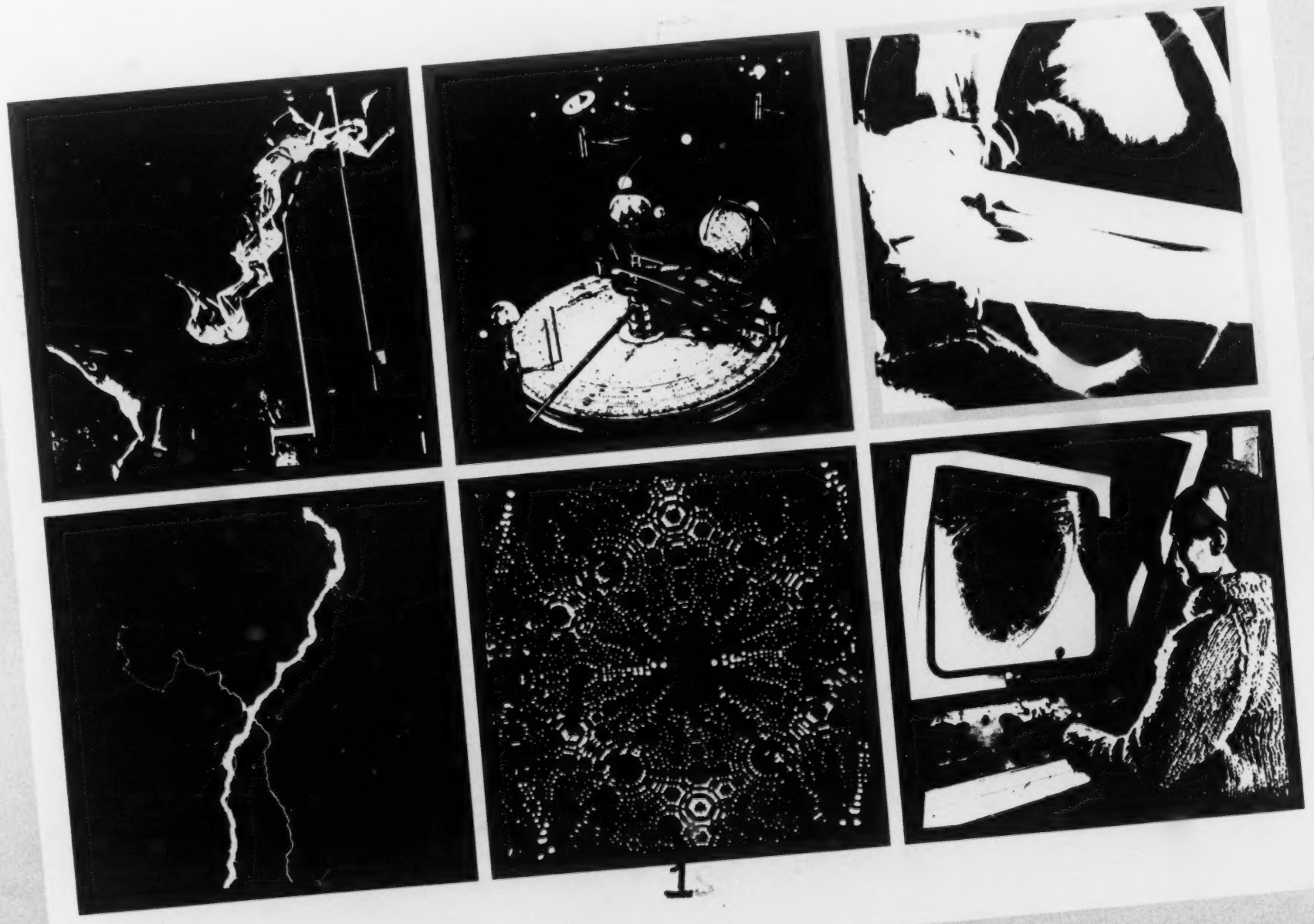
Newsletter 10
Spring 1971

SE 012 361

The Project Physics Course

EDO 54944

Text



Harvard Project Physics, combining the efforts of a group of scientists, scholars, educators and teachers from many parts of the USA and Canada, has developed and tested a set of instructional materials for a new kind of introductory physics course. Designed for secondary schools and 2-year colleges, the course is intended to appeal to a wide variety of students, from the science-oriented to the science-shy, and above all to the growing majority of students who are now taking no physics course at all. Financial support has been provided by the United States Office of Education, the National Science Foundation, the Carnegie Corporation, the Ford Foundation, the Alfred P. Sloan Foundation, Harvard University, and by Project Physics Incorporated, a public, non-profit educational corporation.

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Availability of Course Components

The Project Physics Course is now well launched. The refinement of the basic course components over the past several years through interim versions is finished, and all materials are available to schools in new and final form without restriction. The Project Physics Course is now in use in well over a thousand schools in the U.S. and abroad; the best estimate of the number of students involved in 1970-71 is 80,000. A description of the course—its objectives, conceptual structure, materials, suggested instructional approaches, and evaluation findings — is given in a new booklet entitled *About the Project Physics Course.* It can be obtained free of charge from Francis Harrigan at the address given on this page.

A small staff remains at the headquarters in Cambridge. Please note the new address:

Harvard Project Physics
Longfellow Hall
Appian Way
Cambridge, Mass. 02138
Tel.: [617] 495-2991 or 495-3461/62

Three kinds of activities continue: helping with the implementation of this new course in the nation's schools, particularly through teacher training; supervision of the production of more Supplemental Units and of the version planned for two-year colleges; and cooperation with groups in other countries which are adapting the Project Physics Course materials for local use.

Thus, another major U.S. science curriculum project has come of age, having not only produced for secondary school teachers and their students new materials for the teaching of physics in a humanistic way in order to encompass the concerns of the 1970's and beyond, but having also fostered new modes of classroom learning and teaching. The final version of the materials was written and seen through press by the Codirectors of the Project and the staff of the publisher; but at one point or another literally hundreds of scientists and educators, and tens of thousands of students, were involved in the work since the first feasibility study in 1962. They can all, we believe, justly take pride in the result.

The cover of this Newsletter issue shows, appropriately enough, the newly released hard-cover version of the Project Physics Course Text. (The separate Student Handbook and other course components are not shown.) The authorized U.S. publisher, Holt, Rinehart and Winston, is also the distributor of each of the six parts of the basic Text, bound with the corresponding parts of the Handbook, in six separate soft-cover volumes. Inquiries concerning the availability of the complete Project Physics Course materials—text, student handbook, tests, supplementary units, programmed instruction booklets, film loops, 16-mm films, laboratory equipment, transparencies, teacher resource books, teacher training films, as well as the descriptive catalogue of materials—should all be addressed directly to:

Mr. Francis W. Harrigan
Holt, Rinehart and Winston, Inc.
383 Madison Avenue
New York, New York 10017
Tel.: [212] 688-9100

Examination copies of the printed materials can be made available to teachers or teacher trainers.

Housekeeping Notes

• Holt also has a staff of regional Division Managers; Mr. Harrigan (at the above address) can supply the name, address and telephone number of the Division Manager in your area.

• Mr. Harrigan is also the man to approach regarding all questions involving billing, delivery, etc. We understand that the publisher's strenuous effort to keep up with inquiries and orders is succeeding, but because of the number of components, the size of the traffic, and the necessity of establishing new routines, on some occasions you may be obliged to send Holt a follow-up note, or to place a telephone call if your request appears to have gone unanswered. However, please determine first whether your own organization has really sent out your inquiry as requested, whether shipping address was given fully and correctly, etc.

• Should there be any damage or incomplete shipment of *laboratory apparatus* from the authorized supplier, Holt, you should contact:

Damon Educational
Customer Service Department
80 Wilson Way
Westwood, Mass. 02090
Tel.: [617] 329-3400

• If you wish to be kept on the mailing list of Harvard Project Physics to receive occasional future Newsletters and information about course materials, please cut out the last sheet of this Newsletter and send it back to us now: unless you make such a request, future Newsletter mailings may not reach you.

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Growing Use in Schools

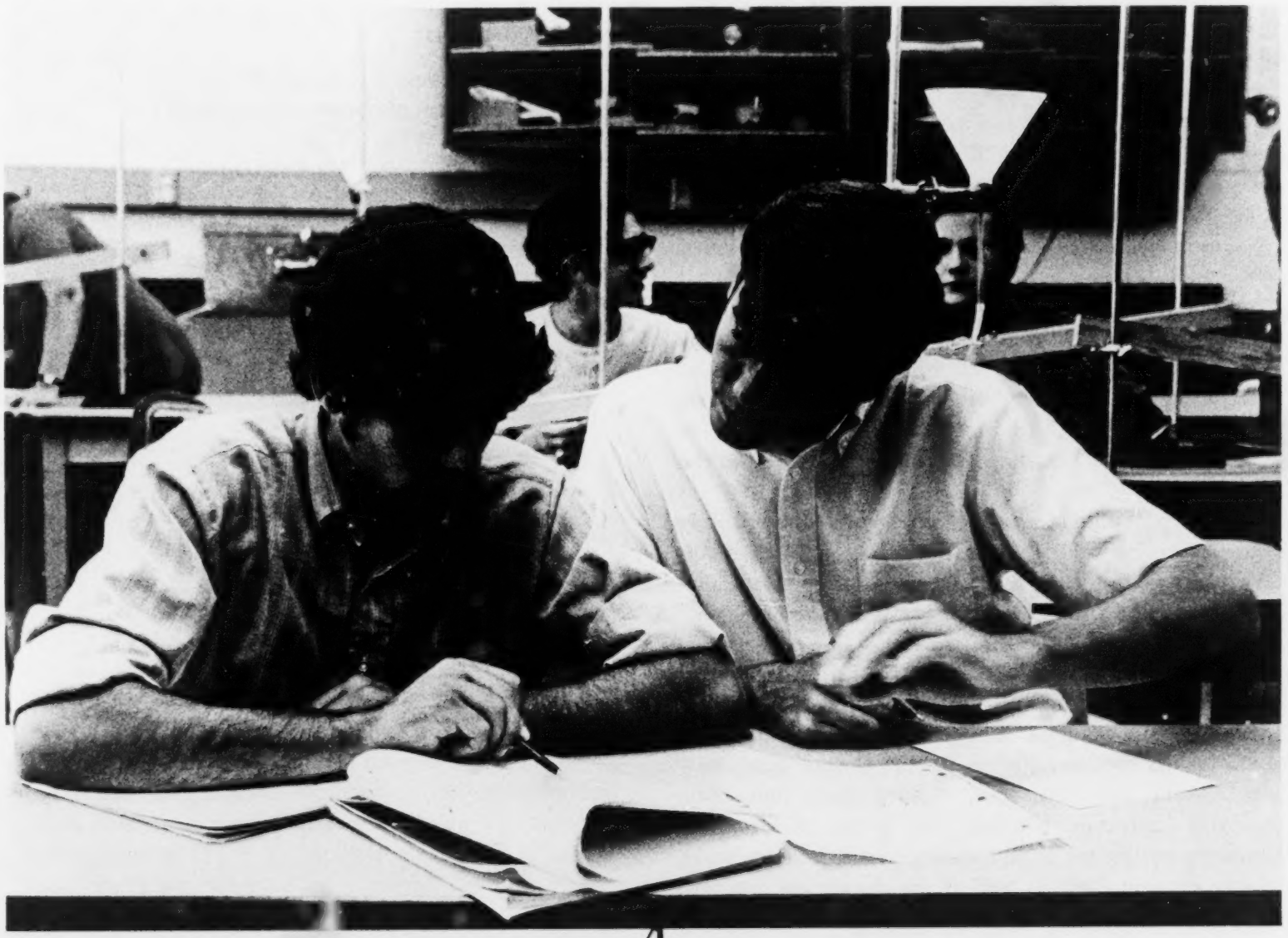
Harvard Project Physics has had a detailed and elaborate program to test, revise and evaluate its materials. Starting in 1964, teachers who agreed to try the course and through their responses to help shape the later editions, have come to Cambridge or other centers to attend summer institutes to acquaint themselves with the new materials and ways of presenting physics.

Each year for the first five years, teachers and students in the trial schools sent back detailed comments about the course materials — what went over particularly well, what seemed obscure or redundant or missing—and these comments were used annually to revise the course for the next test year. The Project Physics staff also frequently made school visits and scheduled a number of national and regional "feedback" conferences for teachers.

During the first two years of testing (1964-66), 16 teachers—acting as field consultants—tried the course with 550 students. In 1966-67, 55 teachers taught the course to 2800 students. In 1967-68, 115 teachers and 6509 students were involved, while the comparable figures for the final years of development were 197 teachers and 8941 students for 1968-69, and 432 teachers with over 20,000 students in 1969-70.

Detailed enrollment data are still being compiled for the current school year, for which the final publisher's version has become available. But the number of copies of the new (1970) text materials in use during the 1970-71 school year was 50,000, and the number of additional copies of the materials in earlier, interim versions still being used in schools from distributions made during the prior test years is estimated at about 30,000. So it is evident that the impact of the Project Physics Course is considerable even in its first regular year (1970-71).

One of the hopes of the staff of Harvard Project Physics has been that the use of this course will help stem the tide running against the study of introductory physics in secondary schools in the U.S. To summarize evidence of this trend: the number of students in public senior high schools taking any variety of introductory physics course was, according to the most recent available statistics of the U.S. Office of Education, only 485,000, less than 20% of the total number of seniors in high schools. As is well known, the percentage of students taking high-school physics in the past two decades has been dropping while those in biology, chemistry, and mathematics courses have either generally held their own or shown gains. In the 1950's, only one high-school student in four elected any physics; in the 60's, the fraction came down further, to less than one in five. At present, more than eighty percent of U.S. high-school students are graduating each year without having had a



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physics course in senior high school, although the subject remains a basic part of education regardless of later career plans. Nothing like this has been experienced in other developed nations.

It is of course too early to tell whether the introduction of the Project Physics Course at this point can help improve this discouraging situation. But early indications from three recent studies are indeed hopeful.

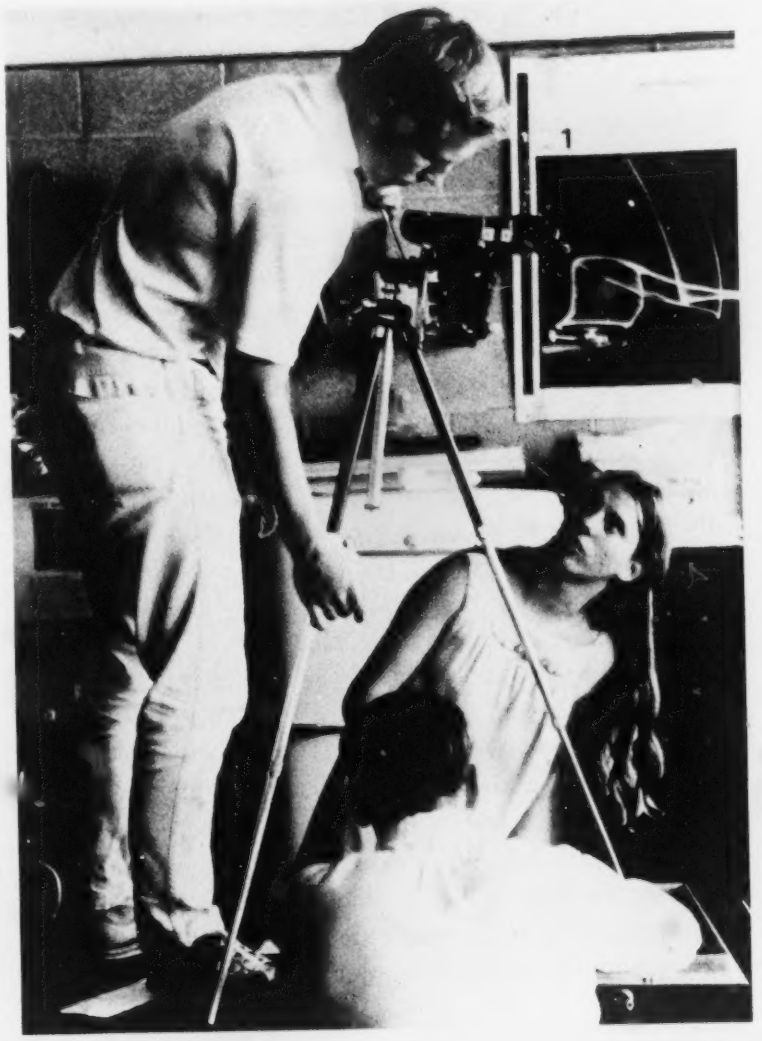
One set of data comes from an independent study carried out late in 1970 at Knox College among the alumni of its Harvard Project Physics teacher-training summer institutes of 1968 and 1969. Thirty-five participants from separate schools responded to the poll. Against a virtually constant total twelfth-grade population in these schools over the last three years, it was found that the introduction of the Project Physics Course changed their physics enrollment statistics drastically. In 1967-68, the year *before* Project Physics in an interim version was introduced in these schools, their total enrollment in all types of physics courses was 1683 students (of which 17% were girls). By 1969-70, the total number of students enrolled in all three types of courses—the Project Physics Course, PSSC, and traditional physics—had increased to 2456 (of which 25.5% were girls). This total figure included 823 students (32% of them girls) in Projects Physics classes.

In short, the total physics enrollment in two years had jumped by 773 students, or 41%. And it should be noted that these schools did not make their gains at the expense of significantly decreasing enrollments in the older types of physics courses: during this same two-year period, the enrollment in traditional physics courses changed from 674 to 610 students, and in PSSC from 1009 to 1023. The 823 Project Physics Course students—one third of all the students taking physics in the year 1969-70 — may well be considered *newly found students* who, through this course, were brought to the study of the subject. This is, of course, precisely what we had hoped would happen.

In a second study, a short questionnaire was sent at the end of the last school year to teachers who were using the interim version Project materials. From all parts of the U.S., 222 replies containing at least some usable data were returned. The survey yielded results which also must be measured against the continuing trend of percentage decreases in student enrollments in physics across the nation.

The total number of twelfth-grade students in these 222 schools was approximately constant, at about 96,200 students over the period from 1968 to 1970. But the total enrollment in all types of physics courses increased from 18,160 students (or 19%) in 1968-69 to 20,689 students (or 21.6%) in 1969-70, and the number of scheduled sections of all types of physics courses increased from 780 to 885. Again, we may consider the growth at least in good part to be coupled to the fact that during the same period the number of Project Physics students in those schools increased from 5,805 to 11,475.

Finally, a third study of this type has come to our attention in which "alumni" of teacher-training institutes held at San Diego State College were asked in 1970 about their experience with Project Physics enrollments. The replies



show that the total number of Project Physics students in their schools went up as follows:

1967-68: 124
1968-69: 399
1969-70: 1231

A good portion of these increases can be attributed to the growing enrollment of girls.

With such a trend, one may hope for an interesting threshold effect to occur. It has long been suggested that the over-all national decline in the proportion of physics students in schools has come about, or has been aggravated in good part, because the teaching of physics, alone among the sciences, has for too many teachers become a second- or third-order occupation. A nation-wide survey conducted by the National Science Foundation showed that in 1961-62 only four percent of all high school physics teachers taught physics exclusively, and 81 percent taught only one or two physics classes (NSF Report 63-10). More recent data are not more cheerful. For example, a statewide survey made in Georgia last year showed that out of the state's 385 high schools offering at least one physics course, only twelve schools offered four or more classes in physics—and hence full-time employment for a professional physics teacher.

In the vast majority of schools, therefore, it is not likely that physics is taught by teachers whose first loyalty and recent training is in physics. This is true wherever the number of physics students drops below a certain threshold. However, the trend of increasing Project Physics enrollments indicated above can, as a side-effect of a most desirable kind, have an impact on physics classes of *all* varieties: teaching physics in senior high school can become a teacher's full-time occupation in many more schools than is now the case. In terms of effectiveness, morale, and support, nothing would help more to attract and hold good teachers, and so provide a better education for students.

High School Awards Program

An article by Professor Alexander Calandra in the December 1970 issue of *The Physics Teacher* reveals that six of the ten high schools chosen by the AAPT from all parts of the U.S. for the 1969-70 award for "outstanding work in physics education" were making use—in a great variety of ways—of Project Physics materials prior to release of the course in final form in fall 1970.

The article recalls that

> "for more than a decade, the Committee on High School Awards, a standing committee of the American Association of Physics Teachers, has annually recognized ten high schools for outstanding work in physics education. The committee and the AAPT-AIP regional counselors cooperate in securing recommendations from those having information about high school physics programs in the various states. . . ."

At least one school is chosen from each of the six geographical regions of the AAPT. Recognition of these schools implies not "that they are the ten best or that they have the most outstanding teachers, but that these schools have excellent teachers and very good physics programs."

The AAPT citations, in part, read as follows:

- "Wheat Ridge Senior High School of Wheat Ridge, Colorado, is a large school which offers both PSSC Physics and Harvard Project Physics courses. A second-year course is offered for students who have completed either first course. It is a continuation course in which new topics are introduced and previous topics are studied more rigorously. Approximately one third of the students take at least one physics course at this school which was a pilot school for Harvard Project Physics. . . ."

- "Mercy Academy in New Orleans, Louisiana, is a small college preparatory school that requires all students to take Harvard Project Physics as freshmen and offers a fourth-year course of special topics. The physics course is characterized by variety and has been accepted with enthusiasm. Such an introductory course, more humanistic than technical, is intended to foster development of a good foundation for science knowledge. . . ."

- "Westchester Senior High School is a very large school in Houston, Texas, with two years of physics course offerings. A variety of instructional materials are used. Included are PSSC items and text; White's text, *Physics: An Exact Science;* and Harvard Project Physics and Berkeley course materials. Second-year students are expected to design and perform research that sometimes assumes rather ambitious proportions. . . ."

- "Burnsville High School is an intermediate-size school in Burnsville, Minnesota, which offers a one-year physics course in which Harvard Project Physics materials are used. Efforts are being made to attract those students who might otherwise avoid science courses, the goal being that all students should have some scientific literacy. . . ."

- "Canton High School, in Canton, Massachusetts, is an intermediate-sized school which offers both PSSC Physics and Harvard Project Physics courses. A very encouraging phenomenon observed at the school is that 71% of the students elect physics. The program is characterized by a variety of materials and emphasis on individual instruction. The goals of the courses are to develop understanding of physical phenomena and to generate appreciation of the influence of physics on culture. . . ."

- "Salesianum School, in Wilmington, Delaware, offers a first-year course in which Harvard Project materials are used, and a second-year course in which the main text is *Physics* by Halliday and Resnick. About 70% of the students enroll in the first-year course. The laboratories are very well equipped for both courses. . . ."

The other four schools cited for excellence are the Edward Clark High School in Las Vegas, Nevada; the Science Hill High School of Johnson City, Tennessee; the Libertyville High School, Libertyville, Illinois; and the Wardensville High School in Wardensville, West Virginia.

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Harvard Project Physics Teacher-Training Institutes, 1970 and 1971

Location of Institutes

Key:

○ Summer Institutes 1970 and/or 1971

□ Inservice Institutes 1970-71

▼ Cooperative College-School Science Programs 1969-70

\+ Academic Year Institutes 1969-70

The map above indicates the location of Inservice Institutes, Summer Institutes, Academic-Year Institutes and Cooperative College-School Science Programs, all specifically directed to the Project Physics teacher for 1970 and 1971.

(Note: This map does not show the secondary schools using the course.)

Summer Institute, Harvard University, 1970 Participants

The National Science Foundation has announced grants for Summer 1971 Teacher-Training Institutes in the following 17 locations (inquiries should be addressed to the local directors at the addresses shown):

W. R. Willis
Northern Arizona University
Department of Physics
Flagstaff, Arizona 86001

Norman F. Dessel
San Diego State College
Department of Physical Science
San Diego, California 92101

A. C. Helmholz
University of California
Department of Physics
Berkeley, California 94704

Richard K. Fry
University of Northern Colorado
Department of Physics
Greeley, Colorado 80631

Paul Westmeyer
Florida State University
Department of Science Education
Tallahassee, Florida 32302

John R. Bolte
Florida Technological University
Department of Physics
Orlando, Florida 32802

O. P. Puri
Clark College
Department of Physics
Atlanta, Georgia 30304

Harry J. Neumiller
Knox College
Department of Chemistry
Galesburg, Illinois 61401

Arnold J. Moore
Kansas City University
College of Education
Manhattan, Kansas 66502

Fletcher G. Watson
Harvard University
Graduate School of Education
Cambridge, Mass. 02138

Walter Eppenstein
Rensselaer Polytechnic Institute
Department of Physics
Troy, New York 12180

Robert L. Sells
SUNY College of Geneseo
Department of Physics
Geneseo, New York, 14454

Robert L. Dough
East Carolina University
Department of Science Education
Greenville, North Carolina 27834

Rudolph M. Gaedke
Trinity University
Department of Physics
San Antonio, Texas 78205

Arnold Arons
University of Washington
Department of Physics
Seattle, Washington 98105

Donald C. Martin
Marshall University
Department of Physics
Huntington, West Virginia 25703

Phillip R. Brieske
Wisconsin State University—Superior
Department of Physics
Superior, Wisconsin 54880

The Summer Institute held at Harvard University in 1970 was specifically directed to experienced Project Physics teachers who agreed, upon return to their home ground, to use local resources to run their own Inservice Institutes for other teachers in the area. While at Harvard, these Master Teachers collaborated to produce a rather informal resource book to help them conduct the day-to-day work of such Inservice Institutes; a few loan copies can be circulated to directors of Institutes on request, from the Harvard Projects Physics headquarters.

Other resources prepared for teachers by the Project are now available from the publisher, Holt, Rinehart and Winston. They are the course's Teacher Resource Book (in six volumes), and 21 Teacher-Training Films on 16-mm film (for rent or purchase). Videotapes of these programs ("Project Physics Teacher Briefings") are available on a long-term lease basis from the National Instructional Television Center, Box A, Bloomington, Indiana 47401 (Tel.: 812 339-2203); preview material consisting of three lessons is available upon request at no charge to those interested in in-school use of the course.

A list of trained Project Physics teachers may be obtained from the Harvard Project Physics headquarters for the use of those who wish to consider selecting consultants for evaluation projects, institutes, foreign adaptation teams, and the like.

Scientists and educators are also reminded that there are many teacher-training programs in which their leadership is needed, e.g. as directors and staff of Summer Institutes or Summer Conferences for Project Physics teachers, or Academic Year Institutes, Inservice Institutes, Cooperative College-School Science Programs, or Resource Personnel Workshops. Literature on any of these may be obtained from the National Science Foundation at 1800 G Street, N.W., Washington, D.C. 20550. Local initiatives are also needed; for example, college scientists are often most welcome to run physics programs for teachers as part of an in-service training program funded by the local school district. For information, contact the head of your high-school science department.

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Adaptations of the Harvard Project Physics Course Outside the USA

Groups in about two dozen countries outside the U.S.—from Canada and Brazil to Italy, Egypt, India and Japan—are either studying or already working on the adaptation of the Project Physics Course materials. Among the recent visitors to our headquarters was a group of 24 scientists and educators from 11 countries who met at Harvard last August for a workshop discussion of methods of adapting the course. The expenses of the visitors were met by grants from NSF, UNESCO, the Asia Foundation, the Ford Foundation, the Creole Foundation and Project Physics Incorporated, a public non-profit educational corporation. The visitors also got a briefing about other curriculum development projects in the U.S. at the International Science Curriculum Clearing House, University of Maryland, under Dr. David Lockard.

From the inception of the Project, its Directors have insisted that use of the materials in other countries should preserve the spirit of the course. However, they do not sanction the wide use abroad of either the U.S. version of the course or of a mere translation *except* during a small-scale pilot program, when it would be needed in the work of an indigenous adaptation group. Adaptations should modify the original printed materials to fit the instructional pattern, the specific culture, the science history and the resources of the particular country. A memorandum regarding foreign adaptations, with guidelines for adaptation teams, is available on request from the Harvard Project Physics headquarters.

Interested scientists and educators in countries outside the United States have also been inquiring how they may obtain sample copies of the U.S. version of materials for teacher training, for use in discussions with colleagues or Ministry of Education Officials, and the like. We have suggested four approaches that have often been found helpful in obtaining such materials: making your request to the cultural attaché or science attaché of the local U.S. Embassy; to the local office of the U.S. Information Service (USIS); to the United Nations Development Program (UNDP) Resident Representative; or to the Division of Science Teaching, UNESCO, Paris 7e, France. In the last two cases, the responsible officer may be able to tell which of the UN-financed educational projects (UNESCO, UNDP Special Fund, UNICEF, etc.) has a science-education component and a budget for such materials, when these are requested for the planning of educational improvements.

Of course, if an interested group abroad is able to purchase the course materials directly, there are no obstacles to doing so. The distributor of the U.S. version of the Project Physics Course (Holt, Rinehart and Winston, at the address given on page 3) is now authorized to supply course materials to purchasers from abroad in limited quantities without having to obtain special permission from the Course Directors. But we are told it is advisable to place any such orders through a bookseller or agent who has experience with importing educational materials from the U.S. by international air freight.

Invited presentations of the content and approach of the

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Project continue. Among the more noteworthy presentations were: the U.S.-India "Bi-National Conference on Physics Education and Research," held in Srinagar, Kashmir, in June 1970; an invited paper, "Pre-Service Pedagogical Formation of Physics Teachers" at Eg , Hungary in September 1970; live demonstrations of some of the Project materials selected by the U.S. State Department as the U.S.A. Exhibit at the International Exhibition of Modern Audio-Visual Teaching Aids in Rangoon, Burma (Dr. John Rigden headed the team of demonstrators who had a total of 497,000 visitors in the U.S. Pavilion during the ten days); another version of the same exhibit, travelling under USIS auspices from Finland through several countries in Europe during the fall and winter of 1970-71; and a five-day NSF-sponsored Seminar on the Project held in Japan in Spring 1971.

The Ministries of Education of Quebec Province (Canada) and of New South Wales (Australia) are the most recent agencies abroad to have sanctioned or initiated pilot use of the Project materials as part of adaptation efforts. We were also interested to hear from a group at the Institute of Theoretical Physics at the University of Naples (Italy), who informs us that it recently gave a six weeks' course on the teaching of physics at the Pedagogical Institute of the University of Havana, Cuba; a portion of the time was spent on the Project Physics materials.

During July 1970 a five-week institute on the Project Physics Course was held by FUNBEC in São Paulo, Brazil, under the leadership of Dr. A. Teixeira and Dr. Myriam Krasilchik. The international group of participants strongly urged efforts to adapt the course for use in Brazil and in Spanish-speaking countries.

Scores on CEEB Physics Achievement Test

The Educational Testing Service of Princeton, New Jersey, has continued to keep an eye on the performance of Project Physics students on the College Entrance Examination Board's physics achievement tests. The recent test results show, just as in previous years, that on the average Project Physics students perform as well as the students of all other physics courses, even though so far the CEEB test has not been expanded to incorporate some of the special features and topics of the Project Physics Course. The specific average scores for the last three test periods reported to us are: 618 for Project Physics versus 599 for the average of the total group (May 1969); 603 versus 591 (January 1970); and 613 versus 619 (May 1970).

The study will continue, to determine the suitability of the CEEB test for Project Physics students. But it is evident that on the whole our students are by no means handicapped when they take the current CEEB tests.

Increasing the Enrollment of Girls

Mr. T. W. Fowler of Burlington High School, Burlington, Massachusetts writes that last year he offered a special Project Physics class for girls only, with the result that there was a considerably increased enrollment by girls. His advice might be useful to others:

> "The Guidance Department knows of the objectives of the different physical science courses, and counsels each student accordingly. We found that successful counselling was of utmost importance. . . . This is accomplished by having students talk with their counsellor, with a physical science teacher, and meeting in groups in the absence of teachers with several students currently taking physics."

Teaching the Project Physics Course to Three Grades Simultaneously

Dave Button, a member of the 1970 Summer Institute, teaches at Brentsville District Junior-Senior High School

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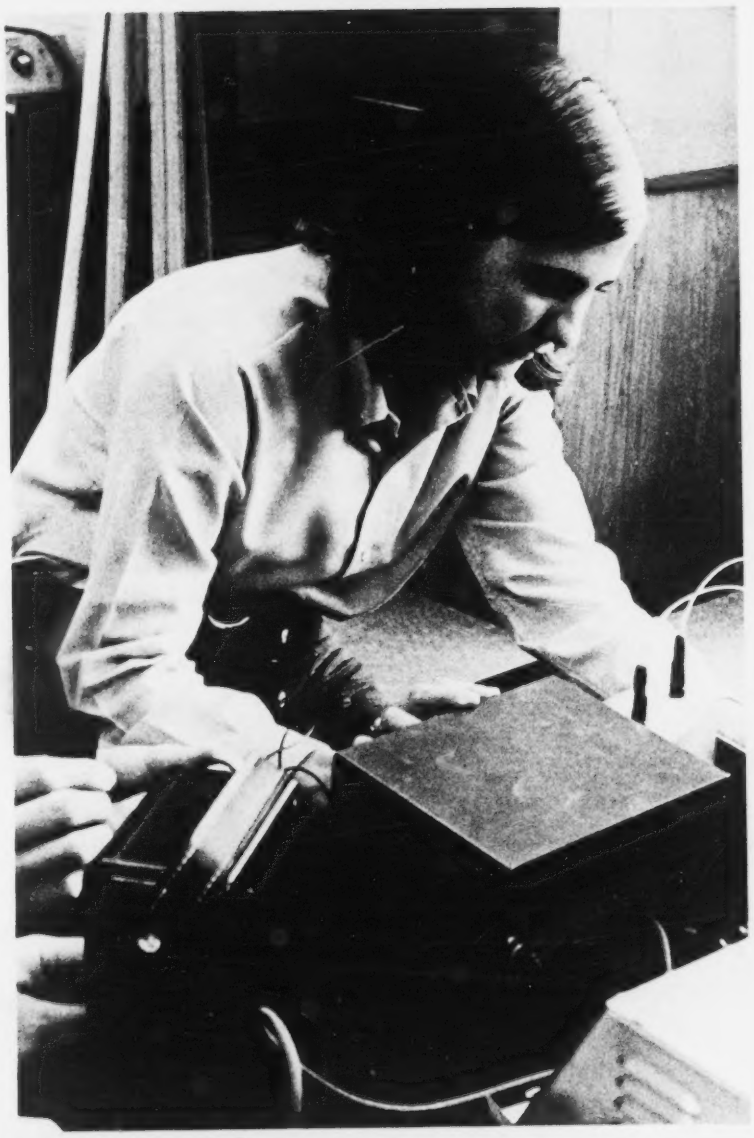

in Nokesville, Virginia. His last letter contains the following information:

"As I mentioned this summer in the institute, I would be having sophomores, juniors and seniors, all in the same class taking the Project Physics Course. Having worked under these conditions for twelve weeks, I think I can make the following evaluation of this program, and you might want to pass it on in the Newsletter.

1. The mixture of these three classes does not add any more social problems, since the sophomores are, as I see it, more competitive, and therefore they are doing their best to show up the seniors and juniors.
2. By allowing sufficient freedom in the program, and still covering the major concepts of the material, each student is getting a great deal out of the course.
3. The students have seen that one does not need three years of mathematics to 'do physics,' and the word has been passed on to the other students, especially to those of the sophomore class who took biology instead.

Perhaps these findings come from my situation because it is a unique one, but the 'problem' that these three classes were supposed to present, according to our guidance office, never materialized. As a matter of fact, some of this year's freshmen have taken it upon themselves to try to get physics taught next year, at least one section, even though it is a 'chemistry' year.

One problem has come up, however; that is how to keep students from other classes out of your physics room when physics is going on. I have several visitors daily who drop by to see what is going on since they know that the material is fun, and most students are enjoying rather than dreading their physics classes."

News & Notes

Personnel. After having helped to shape and move the Project materials since 1964, Dr. Andrew Ahlgren has assumed his new job as Associate Director of the Center for Curriculum Studies and Assistant Professor for Secondary Education at the University of Minnesota. Dr. Robert H. Maybury has returned to the Science Teaching Center of UNESCO in Paris. Dr. James Rutherford was recently awarded the Distinguished Service Medal of the American Association of Physics Teachers. Kim Mehlbach has returned to Wheat Ridge Senior High School in Colorado. Rolland Bartholomew is Assistant Professor of Science Education at University of Texas in Austin, Texas.

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"The World of Enrico Fermi." This documentary film, prepared by the Project for use in schools and colleges, has won the Golden Eagle Award at the 1970 CINE Festival (as did our other documentary film, "People and Particles" a year earlier). The Fermi film has also been shown on some stations of the National Educational Television Network, and additional showings may be scheduled later. Copies of this and the other 16-mm films, for preview, rental or purchase, can be obtained by writing to Mr. Paul Foster, Holt, Rinehart and Winston, Inc. at the address given on page 3. In each case, however, be sure to specify the use to which the film will be put; in showings on television stations, for example, it is vastly preferable to ask for a fresh print, not a preview copy. Also, whenever your showing allows, request specifically the continuous one-reel version (46 minutes) rather than the version in two halves on two reels—and make sure that you have a take-up reel that is big enough to hold 1800 feet of film (e.g. 13¾" diameter reel). Background material and descriptions of all 16-mm Project films will be found in the first volume (Unit 1) of the Project's Teacher Resource Book.

Computer-Based Self-Instructional Course for Secondary School Physics Teachers. The following is an excerpt from the National Science Foundation booklet, *Course Curriculum Improvement Projects* describing a project supported by the National Science Foundation and conducted by Arthur H. Rosenfeld and Noah Sherman at the Lawrence Hall of Science, University of California, Berkeley, Calif. 94720:

> "The purpose of this project is to produce some prototype programs for a computer-based self-instructional course for the Project Physics Course which can be used in training high-school science teachers. The project will involve physicists and science educators who have been concerned for some time with problems of teacher education and also computer scientists who will collaborate in the production of the pilot programs. The motivation for the development of the prototype programs is the potential of such materials as a resource in science education, particularly in the training of school teachers who, through self-instruction, could further the implementation of curriculum innovations. The immediate objectives are the production of about 20 hours of material on suitable fundamental subjects selected from each of the basic units of the Project Physics Course. The programs will be primarily in the conversational mode and will include attempts to incorporate computing, problem solving, modeling, and laboratory simulation."

Errata Sheets for Text. For the soft-cover version of the text (first printing, 1970), a list of errata has been prepared and is available from Mr. Harrigan at Holt, at the address given earlier in this Newsletter. Most of these misprints were corrected in the hard-cover, one-volume version of the basic text (December 1970) and in the second printing (Spring 1971) of the soft-cover version. We shall of course gladly receive indications of any other misprints that may be discovered.

Elementary Particles. A new, revised printing of this Supplemental Unit text is scheduled by Holt for release to schools by the beginning of May 1971.

Recent Articles Referring to Project Physics

- "A New Point of View and Curriculum: The Subject is Physics," *Carnegie Quarterly,* vol. XVIII, No. 4 (Fall 1970), pp. 5-6. For a copy, write to Mrs. Helen Rowan, Editor, *Carnegie Quarterly,* Carnegie Corporation of New York, 437 Madison Avenue, New York, New York 10022.

- "The Relevance of Physics," Gerald Holton, *Physics Today,* vol. 23, No. 11 (November 1970), pp. 40-47.

- "The Harvard Project Physics Film Program," Alfred Bork, *The Physics Teacher,* vol. 8, No. 4 (April 1970), pp. 163-168.

- "Issues for the Seventies," Gerald Holton, *The Physics Teacher,* vol. 8, No. 5 (May 1970), pp. 229-232.

- "The Role of History in the Teaching of Physics," Stephen Brush, *The Physics Teacher,* vol. 7, No. 5 (May 1969), pp. 271-280.

- "Harvard Project Physics: A Report on Its Aims and Current Status," Gerald Holton, *Physics Education,* Volume 4, 1969. pp. 19-25.

- "Two Major Strategies for the Improvement of Science Education," Gerald Holton, Resource Paper 19, Proceedings of the UN-UNESCO Working Party on the Improvement of Science Education with Special Reference to Developing Countries, 15-19 September, 1969 (UNESCO Headquarters, Place de Fontenoy, Paris 7^{e}, France).

- "The Model for Project Beacon," Frank R. Pomilla and Martin S. Spergel, *The Physics Teacher,* vol. 9, No. 4 (March 1971), pp. 130-133.

- "The High School Experience in Project Beacon," Lester Siegel and Robert Weinstein, *The Physics Teacher,* vol. 9, No. 4 (March 1971), pp. 134-139.

- "Assessment and Use of Student Attitudes Toward Physics at the United States Air Force Academy," Paul R. Owens, et al. Copies available from Captain Owens at the Department of the Air Force, Department of Physics, USAF Academy, Colorado 80840; to be submitted to *The Physics Teacher.*

- "Humanizing Learning in Science," Walter Watson. Preprint copies are available from Professor Watson at: Department of Philosophy, State University of New York at Stony Brook, Stony Brook, Long Island, New York 11790.

Other Reading Matter of Interest

• Charles Silberman, *Crisis in the Classroom.* (Random House, New York 1970)

A good discussion of the legacy which we face in the 1970's owing to the forces that have shaped American secondary school education in the last two decades.

• John L. Lewis, *UNESCO Source Book: The Teaching of Physics at the Secondary Level.* (UNESCO)

In press; will contain updated descriptions of the major projects, including Project Physics.

• Walter E. Elliott, "Perceptions of High School Physics and Physics Teachers." *The Physics Teacher,* January 1971. (vol. 9, No. 1)

An interesting study, sponsored in part by the A.I.P. Education and Manpower Division, using data collected in 1968. The recommendations of the report include the following:

"1. Larger high schools should offer a variety of physics courses appealing to a broader spectrum of student interests, abilities, and needs.

2. Smaller high schools offering only a single course in physics should design it to meet a broader spectrum of student interests, abilities and needs.

3. Special emphasis should be put upon the inclusion of course objectives with stronger appeal to girls, to students of average and low-average academic ability, to students not planning academic work after graduation, and to students who tend to be people-oriented. This emphasis implies greater inclusion of social, historical, and political aspects of physics in course objectives.

4. Regular feedback of student perceptions should be used as one basis for continuous modification of physics curricula to better meet the changing needs, interests and abilities of students.

5. Schools should reconsider course prerequisites in light of the preceding recommendations.

6. Schools should consider integrated science courses as another means of introducing more students to the concepts of physics."

• *Science Education: The Task Ahead for the National Science Foundation,* Report NSB-70-42 of the Advisory Committee for Science Education of the National Science Foundation (1970).

Somewhat like the National Academy of Sciences report *The Life Sciences,* which—in 1970—discerned the need for a "humanistic" teaching of biology, this document shows an influential group valiantly trying to adjust to the needs and practices of today. Among the many topics and recommendations, quotations on some major themes will be of interest to readers of this Newsletter:

"We urge that the National Science Foundation give greatly increased emphasis during the next decade to the advancement of the understanding of science and technology by those who are not, and do not expect to be, professional scientists and technologists.

"We believe that the Foundation can and should have much greater involvement in public understanding of science, and particularly in the promotion of general education in the sciences for the young non-scientist, during the coming decade.

"In the past, the emphasis in the Foundation's programs has been on educating future (or potential) scientists in science *per se.* The present and future of society, including science itself, require that emphasis be placed in new directions; specifically, (a) the education of the nonscientist in science and the role of science at all levels of instruction, and (b) the education of the future scientist beyond his discipline to prepare him in skills and attitudes required to play a full role in relating science through technology to the needs of society.

"The feeling among the leaders in course content improvement is that first generation attempts should be followed, not by second attempts at doing the same things, but by precedent-setting attempts to solve key curriculum problems. Courses need to be developed which are relevant to the interests of the students and society, but at the same time capable of preparing the college-bound, science-oriented student for undergraduate work. These must take into account the range of abilities, backgrounds, and varying vocational interests of children and young adults. If this requires more than one kind of approach, then different approaches should be supported, so that all students graduating from high school will be equipped to live in a technological world. Our citizens should be as literate with respect to science and technology as with the traditional three R's.

"Second generation curriculum attempts must emphasize the interdisciplinary nature of science and technology.

"The Committee recommends that much more effort be put into the improvement of courses and teaching of science for the non-science major.

"The Committee recommends the support of interdisciplinary problem-oriented science programs designed to improve and extend the undergraduate conception of science and demonstrate the relevance of science to society."

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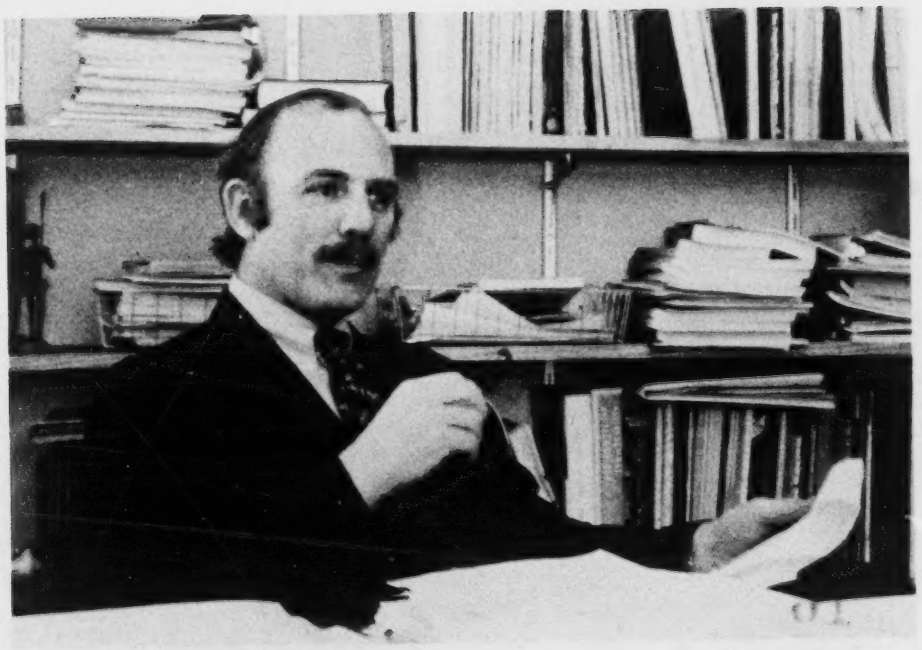

In September, 1971, F. James Rutherford will join the faculty at New York University in Washington Square as Professor of Science Education and Chairman of the Science Education Department; he is leaving a position as Associate Professor of Science Education at Harvard University where he has been since 1964. Professor Rutherford who, along with Professors Gerald Holton and Fletcher G. Watson, was a founder of Harvard Project Physics, will continue as a Codirector and Executive Director of the Project.

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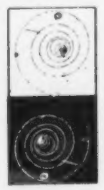

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